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Forest Biomass and Empirical Yield for Kansas

W. Brad Smith and Ronald L. Hackett

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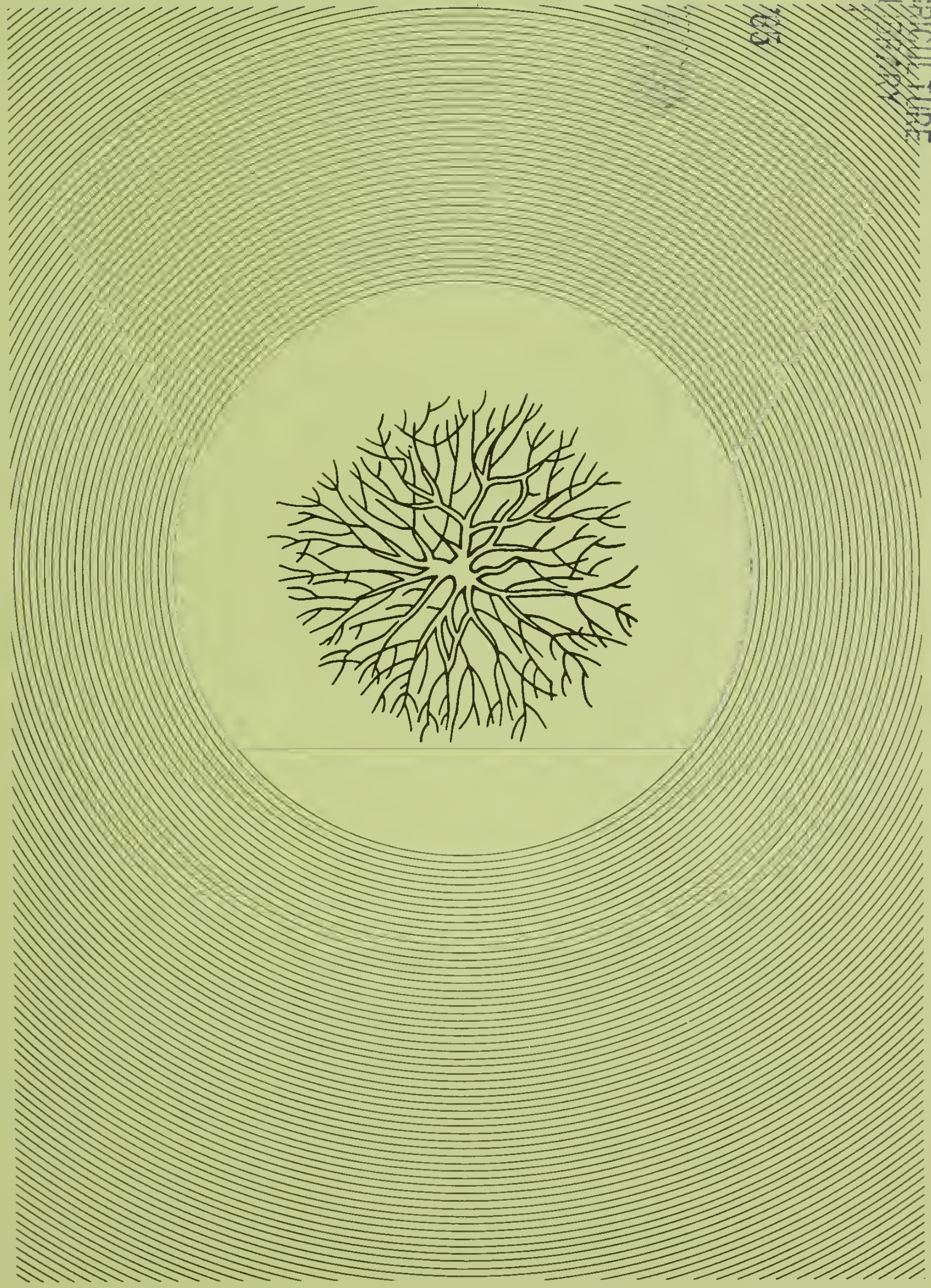

CONTENTS

Page

Forest Biomass 1
  Tree Biomass 1
  Shrub Biomass 2
  Total Above-Ground Biomass 2
Empirical Yield Tables for Kansas 3
Literature Cited 3
Appendix A 4
  Definition of Terms 4
  Principal Tree and Shrub Species Groups in Kansas 5
  Metric Equivalents of Units Used in this Report 6
Appendix B 7
  Biomass Tables 7
Appendix C 12
  Empirical Yield Tables 12

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FOREST BIOMASS AND EMPIRICAL YIELD FOR KANSAS, 1981

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FOREST BIOMASS

In 1981, Kansas' 1.2 million acres of commercial forest land supported 53.3 million green tons of tree biomass or 2.4 billion cubic feet. In addition to tree biomass, 6.7 million tons green weight of shrub biomass were estimated for the State.

Tree Biomass

Method

Tree biomass was estimated by the following method. First, net cubic foot volumes were converted to green tons using weight conversion factors for each species (Markwardt 1930). The weight of the bole bark was then computed using bark correction factors for individual species, the gross volume of the bole, and an average bark weight of 37 pounds per cubic foot. Tops and limbs for growing-stock and cull trees were estimated as 45 percent of the gross bole volume (Young *et al.* 1976). Finally, the biomass for trees less than 5 inches diameter breast height d.b.h. was computed from a regression equation fit to Young's tree weight table (Young *et al.* 1976). This regression equation uses d.b.h. to estimate total aboveground biomass as 80 percent of the above- and belowground biomass.

Findings

Tree biomass is composed of five components. Each component includes bark. Shown in the following tabulation are the five components and amount of biomass for each in Kansas.

Tree component	Kansas biomass (Million green tons)	Kansas biomass (Percent)
1. 1- to 5-inch d.b.h. trees	7.7	14
2. *Growing-stock boles*—from a 1-foot stump to a variable 4-inch top diameter outside the bark.	22.9	43
3. *Growing-stock tops and limbs*—the volume above the variable 4-inch top, excluding the foliage.	11.2	21
4. *Cull boles*—from a 1-foot stump to a variable 4-inch top diameter outside the bark.	7.0	13
5. *Cull tops and limbs*—the volume above the variable 4-inch top, excluding the foliage.	4.5	9
All components	53.3	100

Forty-three percent of Kansas's tree biomass is in growing-stock boles. Growing-stock tops and limbs have the second most biomass with 21 percent (table 1).

Hardwood tree species compose more than 99 percent of the State's tree biomass. Select white oak is the most abundant tree species, accounting for 7.3 million green tons (14 percent) or 478 thousand cubic feet of the tree biomass (table 3). The second most abundant tree species is cottonwood with 6.8 million green tons (13 percent) or 294 thousand cubic feet. The tabulation on the following page, ranks the major hardwood groups.

Tree species[1]	**Tree biomass** (Million green tons)
Select white oak	7.3
Cottonwood	6.8
Hackberry	5.9
Other hardwoods	5.5
Elm	4.2
Ash	4.1
Black walnut	3.8
Select red oak	2.9
Noncommercial species[2]	2.6
Other red oak	2.0
Select hickory	1.9
Other white oak	1.6
Soft maple	1.1
Sycamore	1.0
Other hickory	0.9
Willow	0.8
Basswood	0.4
Eastern redcedar	0.3
Hard maple	0.2
Total	53.3

Shrub Biomass

Shrub biomass on Kansas' commercial forest land was also estimated in conjunction with the forest inventory.

Shrub species were placed into two categories to facilitate sampling—tall and low shrubs. Tall shrubs and trees less than 1 inch d.b.h. were tallied by stem diameter classes. This layer of vegetation is important for winter feed (browse) for wildlife, soil protection, and bird habitat. The low shrubs (ground cover species) were sampled by visually estimating the percent cover. Biomass estimates in weight per acre are shown in table 4.

Method

Stem diameters were measured 6 inches above ground level for all tall shrubs and for tree species less than 1 inch d.b.h. For low shrubs, a visual estimate of percent ground cover was made by species.

Biomass prediction equations (Telfer 1969, Grigal and Ohmann 1977, Ohmann *et al.* 1976, Brown 1976, Roussopoulos and Loomis 1979, Ohmann *et al.* 1981) were applied to shrubs and small tree species. From these equations, total plant biomass (green weight) was calculated by species, using either stem diameter (tall shrubs and trees) or percent ground cover (low shrubs) as a variable.

Findings

Willow forest type has the highest shrub biomass, totaling 2,786 pounds per acre green weight (table 4).

The following tabulation shows the significant amounts of shrub biomass by forest type.

Forest type	**Tall and low shrub biomass** (Green pounds/acre)
Willow	2,786
Eastern redcedar-hardwood	2,767
Upland elm-ash-locust	1,065
Oak-hickory	986
Lowland plains hardwoods	905
Elm-ash-cottonwood	742

Roughleaf dogwood, a tall shrub, yielded the highest weight of above-ground biomass per acre, especially in the willow forest type. In the low shrubs, buckbrush was the most abundant, occurring chiefly in the post-blackjack oak forest type.

Shown in the following tabulation are the most significant tall and low shrub species by forest type and their biomass:

Tall shrub species	**Forest type**	**Shrub biomass** (Green pounds/acre)
Roughleaf dogwood	Willow	1,778
Roughleaf dogwood	Eastern redcedar-hardwood	1,411
Beaked hazel	Eastern redcedar-hardwood	931
Willow	Willow	694
Low shrub species		
Buckbrush	Post-blackjack oak	186
Buckbrush	Upland plains hardwoods	166
Buckbrush	Upland elm-ash-locust	155
Buckbrush	Lowland plains hardwoods	150

Total Above-Ground Biomass

The cottonwood forest type has the highest amount of above-ground biomass with more than 150,000 green pounds per acre. The lowland plains hardwoods type is second with more than 96,000 green pounds per acre. The nonstocked category has the least amount with approximately 31,500 green pounds per acre. The tabulation below gives the tree and shrub biomass estimates by forest type.

---

[1] *See* Principal Tree and Shrub Species Groups in Kansas *in Appendix A.*

[2] *See definition in Appendix A.*

Forest type	Tall shrubs	Low shrubs (Green pounds/ acre)	Trees
Eastern redcedar-hardwood	2,707	60	41,663
Oak-hickory	834	152	94,917
Post-blackjack oak	200	194	92,696
Upland plains hardwoods	493	177	84,509
Elm-ash-cottonwood	582	160	87,719
Cottonwood	474	126	153,088
Willow	2,649	137	59,614
Lowland plains hardwoods	722	183	96,695
Upland elm-ash-locust	892	173	46,346
Nonstocked	189	69	31,226

EMPIRICAL YIELD TABLES FOR KANSAS

Empirical yield tables are useful to managers of timber, wildlife, and other forest resources who are interested in estimates of current commercial forest species composition and volume or in rough, short-term projections of future conditions.

Presented here are yield tables (Appendix C) compiled from data gathered on 636 commercial forest land plots established during the 1981 forest inventory of Kansas. Tables were compiled by forest type and stand-age class. Only tables having sufficient data, usually 3 or 4 plots, in each of two adjacent age classes, are presented; we feel that information based on smaller samples would not be useful.

The tables give the estimated merchantable cubic foot and board foot volume yield per acre from growing stock (including short-log trees) and sawtimber (including short-log trees) respectively and the average basal area per acre of all live trees by stand-age class for most of the forest types defined in Appendix A. These tables provide a detailed picture of stand composition as measured by growing-stock and short-log volume. Other tables show total green weight per acre of biomass for all live trees.

The tables were constructed by classifying the commercial forest land plots measured in the 1981 inventory by forest type and stand-age class. Then the per-acre merchantable cubic foot volume, board foot volume, or the total above-ground biomass was tabulated by species group. The merchantable volume standards used are minimum 5-inch d.b.h. to a 4-inch top diameter outside bark (top d.o.b.)with a 1 foot stump. Individual tree volumes were computed using a formula developed by (Gevorkiantz and Olsen (1955) and described by Smith and Weist 1982. A full explanation of the survey procedures and definitions can be obtained from Raile and Spencer 1982.

Overall, the tables presented in Appendix C give the resource manager an overview of the timber volume in Kansas on a per acre basis by forest type.

The volumes shown in these tables were obtained from plots located in stands with varying histories, from undisturbed stands to ones that had been cut repeatedly. Thus, standard errors of mean volume are given in the tables to indicate their variation. Sampling error in percent can be determined by dividing the standard error by the mean volume of all species; for example, the sampling error for total volume in the oak-hickory type in the 41-50 year age class (table 6) is 9.0 percent ((61/679) ×100).

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APPENDIX A

DEFINITIONS OF TERMS

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Commercial forest land.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of annual growth under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.) Also see definition of pastured commercial forest land.

Commercial species.—Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam and hawthorn.)

Cull.—Portions of a tree that are unusable for industrial wood products, because of rot, form, or other defect.

Forest shrub.—A woody, perennial plant differing from a perennial herb in its persistent and woody stem(s), and less definitely from a tree in its lower stature and/or the general absence of a well-defined main stem. For this report shrubs were separated somewhat arbitrarily into tall and low shrubs as follows:

Tall shrubs.—Shrubs normally taller than 1.6 to 3.2 feet (0.5 to 1.0 meter).

Low shrubs.—Shrubs normally shorter than 1.6 to 3.2 feet (0.5 to 1.0 meter). (Woody perennial vines, such as grape, were included with low shrubs.)

Forest trees.—Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

Forest type.—A classification of forest land based upon the species forming a plurality of live tree stocking. Major forest types in Kansas are:

Eastern redcedar-hardwood.—Forests in which hardwoods comprise a plurality of the stocking but in which eastern redcedar comprises 25 percent or more of the stocking. Found on dry uplands, usually abandoned pastures or fields.

Oak-hickory.—Forests in which upland oaks (white, northern red, black) or hickory, singly or in combination, comprise a plurality of the stocking, except for stands classed as eastern redcedar-hardwood or as post-blackjack oak. Occurs on a variety of soils.

Post-blackjack oak.—Forests in which post oak or blackjack oak, singly or in combination, comprise a majority of the stocking. Occurs on dry uplands and ridges.

Upland plains hardwoods.—Forests in which black walnut, hackberry, and bur oak, singly or in combination, comprise a plurality of the stocking. Commonly found on slopes and uplands.

Elm-ash-cottonwood.—Lowland forest in which elm, ash, cottonwood, and willow, singly or in combination, comprise a plurality of the stocking, except for those in which cottonwood or willow comprise a majority of the stocking. Found on first or second bottoms of major streams.

Cottonwood.—Forests in which cottonwood comprises a majority of the stocking.

Willow.—Forests in which willow comprises a majority of the stocking.

Lowland plains hardwoods.—Forests in which black walnut, hackberry, bur oak, soft maple, and boxelder, singly or in combination, comprise a plurality of the stocking. Commonly found in coves and bottomlands.

Upland elm-ash-locust.—Upland forests in which elm, ash, and honeylocust, singly or in combination, comprise a plurality of the stocking. Includes shelterbelts and windbreaks on sites drier than those commonly associated with lowland species.

Growing-stock trees.—Live trees of commercial species qualifying as desirable and acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume in cubic feet of growing-stock trees 5 inches d.b.h. and over, from a 1-foot stump to a minimum 4-inch top diameter outside bark of the central stem, or to the point where the central stem breaks into limbs. Cubic feet can be converted to cords by multiplying by 79 cubic feet per solid wood cord.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Poletimber trees.—Growing-stock trees of commercial species at least 5 inches in d.b.h., but smaller than sawtimber size.

Productive-reserved forest land.—Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administration regulation, designation, or exclusive use for Christmas-tree production, as indicated by annual shearing.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Saw log.—A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark (d.o.b.) for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting Regional specifications for freedom from defect. Softwoods must be at least 9 inches in d.b.h. Hardwoods must be at least 11 inches in d.b.h.

Sawtimber volume.—Net volume of the saw log portion of live sawtimber in board feet, International ¼-inch rule, from stump to a minimum 7 inches top d.o.b. for softwoods and a minimum 9 inches top d.o.b. for hardwoods.

Short-log (rough tree).—Live trees of commercial species that contain one merchantable 8- to 11-foot saw log but not a 12-foot saw log or two noncontiguous saw logs 8- to 11-feet long, now or prospectively.

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

PRINCIPAL TREE AND SHRUB SPECIES GROUPS IN KANSAS[3]

TREE SPECIES

Softwoods	
Eastern redcedar	*Juniperus virginiana*
Hardwoods	
Select white oak	
Bur oak	*Quercus macrocarpa*
White oak	*Quercus alba*
Chinkapin oak	*Quercus muehlenbergii*
Other white oak	
Post oak	*Quercus stellata*
Select red oak	
Northern red oak	*Quercus rubra*
Shumard oak	*Quercus shumardii*
Other red oak	
Black oak	*Quercus velutina*
Blackjack oak	*Quercus marilandica*
Pin oak	*Quercus palustris*
Shingle oak	*Quercus imbricaria*
Select hickory	
Pecan	*Carya illinoensis*
Shellbark hickory	*Carya laciniosa*

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[3] *The common and scientific names of tree species are based on: Little, Albert L., Jr. Checklist of United States Trees (Native and Naturalized). Agric. Handb. 541. Washington, DC: U.S. Department of Agriculture; 1979. 375 p. The common and scientific names of shrubs are based on: Fernald, Merritt L. Gray's manual of Botany. New York, NY: American Book Company; 1950. 1,632 p.*

Mockernut hickory	*Carya tomentosa*
Shagbark hickory	*Carya ovata*
Other hickory	
Bitternut hickory	*Carya cordiformis*
Black hickory	*Carya texana*
Hard maple	
Sugar maple	*Acer saccharum*
Soft maple	
Silver maple	*Acer saccharinum*
Ash	
Green ash	*Fraxinus pennsylvanica*
White ash	*Fraxinus americana*
Cottonwood	
Eastern cottonwood	*Populus deltoides*
Willow	
Black willow	*Salix nigra*
Basswood	
American basswood	*Tilia americana*
Black walnut	*Juglans nigra*
Elm	
American elm	*Ulmus americana*
Siberian elm	*Ulmus pumila*
Slippery elm	*Ulmus rubra*
Hackberry	*Celtis occidentalis*
Sycamore	*Platanus occidentalis*
Other hardwoods	
Boxelder	*Acer negundo*
Black cherry	*Prunus serotina*
Black locust	*Robinia pseudoacacia*
Honeylocust	*Gleditsia triacanthos*
Kentucky coffeetree	*Gymnocladus dioicus*
Northern catalpa	*Catalpa speciosa*
Common persimmon	*Diospyros virginiana*
Red mulberry	*Morus rubra*
River birch	*Betula nigra*
Sugarberry	*Celtis laevigata*
Texas buckeye	*Aesculus glabra* var. *arguta*
Noncommercial species	
Ailanthus	*Ailanthus altissima*
Eastern redbud	*Cercis canadensis*
Hawthorn	*Crataegus* spp.
Osage-orange	*Maclura pomifera*
Eastern hophornbeam	*Ostrya virginiana*

SHRUB SPECIES

Tall shrubs	
Roughleaf dogwood	*Cornus drummondii*
Chokecherry	*Prunus virginiana*
Wild plum	*Prunus* spp.
Pawpaw	*Asimina triloba*
Beaked hazel	*Corylus cornuta*
Prickly ash	*Xanthoxylum americanum*
Viburnum	*Viburnum* spp.
Elder	*Sambucus* spp.
Sumac	*Rhus* spp.
Buttonbush	*Cephalanthus occidentalis*
Wahoo	*Euonymus atropurpureus*
Willow	*Salix* spp.
Sassafras	*Sassafras albidum*
Low shrubs	
Virginia creeper	*Parthenocissus* spp.
Gooseberry-currant	*Ribes* spp.
Raspberry-blackberry	*Rubus* spp.
Rose	*Rosa* spp.
American bladdernut	*Staphylea trifolia*
Bilberry-blueberry	*Vaccinium* spp.
Honeysuckle	*Lonicera* spp.
Buckbrush	*Symphoricarpos* spp.
Poison ivy	*Rhus radicans*
Pipe-vine	*Aristolochia tomentosa*
Moonseed	*Menispermum canadense*
Greenbrier	*Smilax* spp.
Grape	*Vitis* spp.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30./48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.
1 pound = 0.454 kilogram.
1 ton = 0.907 metric ton.

APPENDIX B

BIOMASS TABLES

Table 1.--All live tree biomass weight by species group and tree biomass component, Kansas, 1981

(In green tons)

		Biomass component				
			Growing stock		Cull	
Species group	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs
Eastern redcedar	327,473	185,195	76,966	39,582	16,506	9,224
Select white oak	7,258,998	303,255	3,425,768	1,694,337	1,147,605	688,033
Other white oak	1,602,916	302,447	722,386	337,549	149,595	90,939
Select red oak	2,940,607	127,093	1,626,511	806,614	199,869	180,520
Other red oak	1,951,281	113,136	995,059	513,525	194,493	135,068
Select hickory	1,910,715	269,215	961,548	454,587	136,856	88,509
Other hickory	926,926	207,121	429,551	199,223	58,796	32,235
Hard maple	246,808	80,305	100,799	51,224	9,013	5,467
Soft maple	1,069,121	37,415	568,119	280,018	98,492	85,077
Ash	4,063,618	643,970	1,798,134	950,412	395,050	276,052
Cottonwood	6,758,532	42,901	4,089,652	1,992,493	350,178	283,308
Willow	847,383	70,076	363,096	182,509	129,187	102,515
Basswood	386,444	71,834	160,590	78,287	45,154	30,579
Black walnut	3,756,931	462,570	1,810,684	897,619	359,420	226,638
Elm	4,249,130	1,675,863	954,679	460,438	716,885	441,265
Hackberry	5,858,598	897,608	2,696,133	1,312,562	589,163	363,132
Sycamore	1,035,946	36,229	621,590	293,367	45,665	39,095
Other hardwoods	5,472,704	1,079,314	1,391,436	682,228	1,379,817	939,909
Noncommercial species	2,613,645	1,077,736	--	--	1,013,171	522,738
All species	53,277,776	7,683,283	22,792,701	11,226,574	7,034,915	4,540,303

Table 2.--All live tree biomass volume by species group and tree biomass component, Kansas, 1981

(In thousand cubic feet)

		Biomass component				
			Growing stock		Cull	
Species group	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs
Eastern redcedar	17,701	10,010	4,160	2,140	892	499
Select white oak	478,014	41,321	223,042	110,731	63,799	39,121
Other white oak	56,862	10,384	25,633	11,992	5,449	3,404
Select red oak	103,985	4,364	56,954	28,258	7,408	7,001
Other red oak	68,077	3,829	34,501	17,850	6,940	4,957
Select hickory	72,506	9,539	36,600	17,353	5,460	3,554
Other hickory	32,220	7,009	15,003	6,961	2,087	1,160
Hard maple	9,386	3,022	3,846	1,956	349	213
Soft maple	46,315	1,615	24,462	12,060	4,322	3,856
Ash	174,828	27,287	77,186	40,845	17,208	12,302
Cottonwood	294,105	1,818	177,508	86,499	15,405	12,875
Willow	36,529	2,917	15,540	7,815	5,658	4,599
Basswood	19,326	3,556	8,028	3,915	2,275	1,552
Black walnut	136,037	16,867	65,030	32,282	13,254	8,604
Elm	167,526	65,145	37,546	18,117	28,636	18,082
Hackberry	250,191	37,361	115,285	56,136	25,467	15,942
Sycamore	41,662	1,456	24,869	11,739	1,907	1,691
Other hardwoods	240,277	45,761	60,578	29,730	61,441	42,767
Noncommercial species	110,226	44,859	--	--	43,067	22,300
All species	2,355,773	338,120	1,005,771	496,379	311,024	204,479

Table 3.--All live tree biomass on commercial forest land by species group and forest type, Kansas, 1981

(In green tons)

Species	All types	Forest type									
		Eastern redcedar-hardwood	Oak-hickory	Post-blackjack oak	Upland plains hardwoods	Elm-ash-cottonwood	Cottonwood	Willow	Lowland plains hardwoods	Upland elm-ash-locust	Non-stocked
Eastern redcedar	327,473	191,845	40,070	--	28,064	4,008	--	--	29,936	28,607	4,943
Select white oak	7,258,998	91,752	4,673,485	31,917	331,122	440,157	--	--	1,557,223	97,346	35,996
Other white oak	1,602,916	38,832	467,252	1,073,883	19,513	--	--	--	--	3,436	--
Select red oak	2,940,607	4,037	2,375,982	67,344	43,040	131,694	--	--	213,358	101,190	3,962
Other red oak	1,951,281	--	1,542,203	166,773	23,692	79,286	1,794	--	95,554	26,937	15,042
Select hickory	1,910,715	7,190	1,490,954	22,309	24,027	200,292	--	--	105,367	57,197	3,379
Other hickory	926,926	--	518,191	19,908	49,021	88,421	--	--	243,396	7,989	--
Hard maple	246,808	--	147,954	--	--	68,317	--	--	10,448	20,089	--
Soft maple	1,069,121	--	20,155	--	--	772,645	13,213	--	249,481	10,270	3,357
Ash	4,063,618	8,210	477,086	--	58,152	2,492,180	85,263	11,814	685,297	196,554	49,062
Cottonwood	6,758,532	1,560	71,515	--	32,237	1,729,227	4,494,369	17,486	259,323	102,048	50,767
Willow	847,383	--	17,939	--	2,632	588,569	65,544	85,509	47,907	30,718	8,565
Basswood	386,444	--	171,258	--	77,858	27,178	43,118	--	42,362	24,670	--
Black walnut	3,756,931	52,690	766,988	17,073	401,339	369,970	28,655	--	1,932,843	178,600	8,773
Elm	4,249,130	39,858	717,096	14,107	187,401	1,466,383	60,844	3,221	989,815	631,686	138,719
Hackberry	5,858,598	16,942	396,428	4,240	339,359	977,604	51,832	358	3,865,563	171,587	34,685
Sycamore	1,035,946	--	146,290	--	15,292	343,938	16,250	--	477,916	30,488	5,772
Other hardwoods	5,472,704	21,463	423,971	7,972	181,870	2,204,373	350,246	6,802	1,542,446	536,062	197,499
Noncommercial species	2,613,645	98,496	560,570	6,633	272,761	717,505	1,519	--	507,371	300,481	148,309
All species	53,277,776	572,875	15,025,387	1,432,159	2,087,380	12,701,747	5,212,647	125,190	12,855,606	2,555,955	708,830

Table 4.--All live shrub biomass yields on commercial forest land by species group and forest type, Kansas, 1981

(In pounds per acre green weight)

Species	Forest type Eastern redcedar-hardwood	Oak-hickory	Post-blackjack oak	Upland plains hardwoods	Elm-ash-cottonwood	Cottonwood	Willow	Lowland plains hardwoods	Upland elm-ash-locust	Non-stocked
TALL SHRUBS										
Eastern redcedar	244	11	2	13	3	--	--	--	9	--
Boxelder	--	--	--	--	13	39	--	10	--	--
Silver maple	--	--	--	--	10	--	--	--	--	--
Sugar maple	--	3	--	--	2	--	--	--	5	--
Ailanthus	--	75	--	--	--	--	--	--	--	--
Bitternut hickory	--	14	5	12	--	--	--	8	--	--
Shagbark hickory	5	14	--	2	--	--	--	--	1	--
Hackberry	--	29	5	18	20	1	--	107	3	2
Eastern redbud	--	34	20	44	23	--	--	9	16	--
Roughleaf dogwood	1,411	215	55	164	253	239	1,778	173	561	92
Hawthorn	--	12	--	--	14	--	--	--	3	--
White ash	--	8	--	--	--	--	--	--	4	--
Green ash	--	118	1	12	19	82	--	136	15	--
Honeylocust	1	8	--	18	29	--	--	8	30	6
Black walnut	--	13	--	25	3	--	--	12	5	--
Osage-orange	--	5	--	28	1	--	--	--	7	6
Red mulberry	--	5	2	3	7	37	177	2	9	--
Eastern hophornbeam	--	18	4	3	--	--	--	--	--	--
Eastern cottonwood	--	--	--	--	4	--	--	--	--	--
Black cherry	--	3	--	11	--	--	--	--	1	3
Chokecherry	--	11	--	2	2	30	--	11	4	--
Wild plum	--	--	--	--	3	--	--	3	2	--
Pawpaw	--	7	--	15	2	--	--	21	--	--
White oak	--	--	46	--	--	--	--	--	--	--
Bur oak	--	4	1	1	--	--	--	4	--	--
Chinkapin oak	24	15	1	5	--	--	--	10	5	--
Northern red oak	5	8	8	--	--	--	--	2	8	--
Black oak	1	5	--	--	--	--	--	--	10	--
Beaked hazel	931	32	--	--	--	--	--	25	--	--
Prickly ash	--	--	--	30	58	--	--	--	3	--
Viburnum	--	5	--	1	--	--	--	--	--	--
Elder	--	6	--	--	19	--	--	--	--	--
Sumac	39	22	28	1	7	--	--	4	49	70
Buttonbush	--	--	--	--	2	--	--	--	--	--
Wahoo	--	4	--	--	--	--	--	2	--	--
Willow	--	--	--	--	29	28	694	1	--	3
Sassafras	--	2	--	--	--	--	--	--	--	--
American basswood	--	3	--	15	--	2	--	--	--	--
American elm	46	66	22	49	39	--	--	148	108	7
Siberian elm	--	5	--	--	--	--	--	--	--	--
Slippery elm	--	54	--	21	20	16	--	26	34	--
Total	2,707	834	200	493	582	474	2,649	722	892	189

(Table 4 continued on next page)

(Table 4 continued)

Species	Forest type									
	Eastern redcedar-hardwood	Oak-hickory	Post-blackjack oak	Upland plains hardwoods	Elm-ash-cottonwood	Cottonwood	Willow	Lowland plains hardwoods	Upland elm-ash-locust	Non-stocked
LOW SHRUBS										
Virginia creeper	2	7	3	1	--	30	--	3	--	--
Gooseberry-currant	--	8	--	--	12	2	--	9	2	--
Raspberry-blackberry	--	--	1	--	--	--	8	1	3	--
Rose	--	3	--	--	1	--	--	--	6	4
American bladdernut	--	3	--	--	1	--	--	--	--	--
Bilberry-blueberry	--	2	--	--	--	--	--	--	--	--
Honeysuckle	--	--	--	7	7	13	--	6	2	--
Buckbrush	58	119	186	166	128	18	129	150	155	59
Poison ivy	--	6	2	2	10	58	--	8	4	6
Pipe-vine	--	--	2	1	--	--	--	--	--	--
Moonseed	--	4	--	--	1	--	--	3	--	--
Greenbrier	--	--	--	--	--	3	--	1	1	--
Grape	--	--	--	--	--	2	--	2	--	--
Total	60	152	194	177	160	126	137	183	173	69
All shrub species	2,767	986	394	670	742	600	2,786	905	1,065	258
Number of plots[1]	20	265	26	42	206	32	4	213	90	33

[1] Number of plots by forest type from which average yields were derived.

Table 5.--All live tree biomass yields on commercial forest land by species group and forest type, Kansas, 1981

(In pounds per acre green weight)

Species	Forest type									
	Eastern redcedar-hardwood	Oak-hickory	Post-blackjack oak	Upland plains hardwoods	Elm-ash-cottonwood	Cottonwood	Willow	Lowland plains hardwoods	Upland elm-ash-locust	Non-stocked
Eastern redcedar	13,952	253	--	1,136	28	--	--	225	519	218
Select white oak	6,673	29,524	2,066	13,405	3,040	--	--	11,713	1,765	1,586
Other white oak	2,824	2,952	69,507	790	--	--	--	--	62	--
Select red oak	294	15,010	4,359	1,743	909	--	--	1,605	1,835	175
Other red oak	--	9,742	10,794	959	548	53	--	719	488	663
Select hickory	523	9,418	1,444	973	1,383	--	--	793	1,037	149
Other hickory	--	3,273	1,289	1,985	611	--	--	1,831	145	--
Hard maple	--	935	--	--	472	--	--	79	364	--
Soft maple	--	127	--	--	5,336	388	--	1,877	186	148
Ash	597	3,014	--	2,354	17,211	2,504	5,626	5,155	3,565	2,161
Cottonwood	113	452	--	1,305	11,942	131,993	8,327	1,951	1,850	2,236
Willow	--	113	--	107	4,065	1,925	40,718	360	557	377
Basswood	--	1,082	--	3,152	188	1,266	--	319	447	--
Black walnut	3,832	4,845	1,105	16,248	2,555	842	--	14,537	3,238	386
Elm	2,899	4,530	913	7,587	10,127	1,787	1,534	7,445	11,455	6,111
Hackberry	1,232	2,504	274	13,739	6,751	1,522	170	29,074	3,111	1,528
Sycamore	--	924	--	619	2,375	477	--	3,595	553	254
Other hardwoods	1,561	2,678	516	7,364	15,223	10,286	3,239	11,601	9,721	8,700
Noncommercial species	7,163	3,541	429	11,043	4,955	45	--	3,816	5,448	6,534
All species	41,663	94,917	92,696	84,509	87,719	153,088	59,614	96,695	46,346	31,226
Number of plots[1/]	20	265	27	42	206	37	4	213	90	33

[1/] Number of plots by forest type from which average yields were derived.

APPENDIX C

EMPIRICAL YIELD TABLES

Table 6.--Cubic foot volume per acre in growing-stock and short-log trees by species group and stand-age class, Kansas, 1981[1]

Oak-hickory forest type - All site index classes

(In cubic feet per acre)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	2	--	5	2	--	6	--	--	--	--	--
Select white oak	209	199	144	192	258	185	292	146	318	333	294
Other white oak	22	7	15	31	34	44	31	49	21	5	--
Select red oak	125	40	102	189	124	171	216	116	196	140	151
Other red oak	80	46	58	34	65	104	82	78	189	120	184
Select hickory	71	165	71	40	97	64	60	130	99	65	74
Other hickory	22	13	33	25	40	33	18	2	28	21	13
Hard maple	5	--	5	9	--	11	--	10	8	19	4
Soft maple	1	--	--	--	--	--	--	12	6	--	--
Ash	25	7	35	30	26	22	64	16	21	49	10
Cottonwood	5	3	--	12	3	--	11	--	--	14	--
Willow	1	--	--	--	3	--	5	--	--	--	5
Basswood	11	--	1	14	8	29	5	12	10	10	17
Black walnut	43	34	24	44	71	68	54	61	31	39	28
Elm	19	24	13	14	21	28	17	30	26	22	22
Hackberry	23	12	13	22	29	33	23	3	77	16	24
Sycamore	9	9	4	--	3	16	2	12	32	24	--
Other hardwoods	15	17	28	21	7	16	21	3	20	18	11
All species	688	576	551	679	789	830	901	680	1,082	895	837
Number of plots	252	14	20	22	27	24	25	17	18	20	11
Standard error	27	166	104	61	67	86	73	61	103	91	77
Average basal area	68	67	66	73	86	73	80	63	89	72	72

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 7.--Cubic foot volume per acre in growing-stock and short-log trees by species group and stand-age class, Kansas, 1981[1]

Post-blackjack oak forest type - All site index classes

(In cubic feet per acre)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	18	--	84	--	83	--	--	19	--	--	--
Other white oak	473	225	427	626	396	337	431	555	--	201	--
Select red oak	34	--	66	11	104	--	--	--	--	405	--
Other red oak	76	152	50	102	44	--	56	35	--	--	--
Select hickory	11	--	--	14	--	--	43	8	--	--	--
Other hickory	5	--	--	--	--	--	47	--	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	--	--	--	--	--	--	--	--	--	--	--
Ash	--	--	--	--	--	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--
Willow	--	--	--	--	--	--	--	--	--	--	--
Basswood	--	--	--	--	--	--	--	--	--	--	--
Black walnut	9	--	17	3	--	--	38	10	--	--	--
Elm	1	--	--	--	--	26	--	--	--	--	--
Hackberry	2	--	--	--	--	--	--	20	--	--	--
Sycamore	--	--	--	--	--	--	--	--	--	--	--
Other hardwoods	6	--	--	--	--	--	--	28	--	66	--
All species	635	377	644	756	627	363	615	675	--	672	--
Number of plots	26	1	4	10	1	1	3	3	--	1	--
Standard error[3]	60	R	144	114	R	R	153	126	--	R	--
Average basal area	80	82	102	89	71	56	60	74	--	71	--

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

[3] R indicates that there was an insufficient number of plots to compute the standard error.

Table 8.--Cubic foot volume per acre in growing-stock and short-log trees by species group and stand-age class, Kansas, 1981[1]

Upland plains hardwoods forest type - All site index classes

(In cubic feet per acre)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	6	--	26	--	--	--	--	--	--	--	--
Select white oak	98	68	--	114	170	122	108	117	--	151	297
Other white oak	8	--	--	18	--	--	--	--	--	--	--
Select red oak	19	--	--	10	42	13	--	241	--	--	--
Other red oak	10	--	--	8	20	42	--	--	--	--	--
Select hickory	9	--	--	10	16	7	63	--	--	--	--
Other hickory	12	--	34	37	--	--	--	78	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	--	--	--	--	--	--	--	--	--	--	--
Ash	15	18	--	--	34	10	--	--	--	--	80
Cottonwood	13	--	--	--	--	27	--	--	--	--	175
Willow	1	--	--	11	--	--	--	--	--	--	--
Basswood	38	--	--	--	--	124	579	--	--	--	--
Black walnut	140	241	96	229	260	92	--	97	--	160	88
Elm	32	18	53	52	16	20	24	--	--	--	13
Hackberry	102	220	98	57	132	268	54	119	--	--	20
Sycamore	6	--	--	30	--	9	--	66	--	--	--
Other hardwoods	47	19	102	--	35	140	--	44	--	61	27
All species	556	584	409	576	725	874	828	762	--	372	700
Number of plots	39	3	5	4	5	6	1	1	--	1	2
Standard error[3]	60	235	87	122	106	271	R	R	--	R	166
Average basal area	66	69	79	72	64	73	64	82	--	49	67

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

[3] R indicates that there was an insufficient number of plots to compute the standard error.

Table 9.--Cubic foot volume per acre in growing-stock and short-log trees by species group and stand-age class, Kansas, 1981[1]

Elm-ash-cottonwood forest type - All site index classes

(In cubic feet per acre)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	4	--	--	--	--	--	--	--	--
Select white oak	27	4	20	30	26	31	23	75	94	36	--
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	9	9	8	--	19	12	--	30	--	--	--
Other red oak	5	6	--	--	--	18	--	5	--	--	--
Select hickory	13	7	14	--	36	11	26	17	--	--	--
Other hickory	6	--	5	5	7	6	--	--	--	--	--
Hard maple	4	--	--	--	--	8	--	32	--	--	--
Soft maple	73	5	--	51	101	88	200	58	254	139	--
Ash	145	95	198	295	215	147	301	164	171	192	--
Cottonwood	126	20	32	6	77	355	105	210	191	814	--
Willow	35	8	32	50	104	82	31	11	4	--	--
Basswood	2	--	--	17	--	2	--	9	--	--	--
Black walnut	23	20	18	50	26	37	19	16	9	63	--
Elm	59	73	34	36	61	95	96	81	14	25	--
Hackberry	62	68	39	146	122	54	69	68	22	45	--
Sycamore	34	25	18	--	47	82	84	37	28	--	--
Other hardwoods	91	86	107	187	117	187	140	34	76	65	--
All species	714	426	529	873	958	1,215	1,094	847	863	1,379	--
Number of plots	189	12	12	10	26	21	20	18	7	4	--
Standard error	48	70	111	208	131	196	132	123	324	432	--
Average basal area	66	59	78	65	84	84	81	79	65	81	--

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[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 10.--Cubic foot volume per acre in growing-stock and short-log trees by species group and stand-age class, Kansas, 1981[1]

Cottonwood forest type - All site index classes

(In cubic feet per acre)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	--	--	--	--	--	--	--	--	--	--	--
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	--	--	--	--	--	--	--	--	--	--	--
Other red oak	1	13	--	--	--	--	--	--	--	--	--
Select hickory	--	--	--	--	--	--	--	--	--	--	--
Other hickory	--	--	--	--	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	2	--	--	30	--	--	--	--	--	--	--
Ash	26	--	--	28	--	18	25	61	23	93	--
Cottonwood	1,306	738	783	687	1,534	1,658	1,086	2,087	2,020	1,296	--
Willow	20	24	4	29	--	35	34	--	18	--	--
Basswood	3	--	--	--	--	--	--	57	--	--	--
Black walnut	10	--	--	--	--	38	--	--	--	--	--
Elm	16	--	--	--	--	36	--	82	27	--	--
Hackberry	7	--	--	--	--	23	--	--	--	10	--
Sycamore	6	--	--	--	--	6	--	--	49	--	--
Other hardwoods	21	--	--	--	21	31	18	99	--	24	--
All species	1,418	775	787	774	1,555	1,845	1,163	2,386	2,137	1,423	--
Number of plots	35	2	3	2	3	9	5	2	3	4	--
Standard error	166	131	266	328	504	377	455	713	565	363	--
Average basal area	90	73	65	68	86	100	76	154	105	114	--

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[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 11.--Cubic foot volume per acre in growing-stock and short-log trees by species group and stand-age class, Kansas, 1981[1]

Lowland plains hardwoods forest type - All site index classes

(In cubic feet per acre)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	1	--	3	--	--	--	1	--	--	--	--
Select white oak	93	17	35	96	50	91	131	270	120	282	400
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	13	--	8	--	27	17	13	14	20	28	--
Other red oak	5	--	--	5	4	7	--	6	--	17	--
Select hickory	6	--	14	--	13	12	--	6	4	--	--
Other hickory	16	--	58	14	26	7	13	21	17	--	--
Hard maple	1	--	--	--	4	--	--	--	--	--	--
Soft maple	22	--	--	--	45	56	12	6	27	--	--
Ash	41	--	26	35	64	50	47	80	40	43	--
Cottonwood	17	29	11	--	21	12	10	--	48	125	--
Willow	2	--	12	--	3	--	6	--	--	--	--
Basswood	3	--	3	--	--	--	5	10	--	8	--
Black walnut	132	94	218	163	198	165	121	37	90	88	62
Elm	36	35	40	22	37	40	41	37	51	92	49
Hackberry	267	127	210	193	275	277	362	547	281	437	350
Sycamore	43	27	19	--	44	44	85	13	75	--	207
Other hardwoods	63	19	93	118	67	76	87	56	29	18	--
All species	761	348	750	646	878	854	934	1,103	802	1,138	1,068
Number of plots	205	10	17	9	29	35	37	11	17	6	2
Standard error	31	45	56	109	68	76	71	138	80	233	501
Average basal area	72	51	82	67	77	75	81	86	69	95	88

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[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 12.--Cubic foot volume per acre in growing-stock and short-log trees by species group and stand-age class, Kansas, 1981[1]

Upland elm-ash-locust forest type - All site index classes

(In cubic feet per acre)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	6	29	15	53	--	--	--	--	--	--	--
Select white oak	12	--	38	58	--	82	11	83	--	--	--
Other white oak	1	--	--	--	--	--	13	--	--	--	--
Select red oak	16	8	--	--	--	387	11	220	--	--	--
Other red oak	4	--	9	--	--	71	--	--	27	--	--
Select hickory	9	--	--	71	--	103	--	33	76	--	--
Other hickory	2	--	--	--	--	81	12	--	--	--	--
Hard maple	5	--	--	--	--	401	--	--	--	--	--
Soft maple	3	--	--	--	--	--	--	--	--	--	--
Ash	19	--	6	--	--	--	68	183	--	--	--
Cottonwood	13	18	19	--	--	--	51	--	--	--	330
Willow	3	--	--	--	--	--	21	--	--	--	--
Basswood	8	--	--	--	--	547	--	38	--	--	--
Black walnut	30	10	75	181	33	83	22	21	99	--	--
Elm	39	34	24	165	160	--	130	51	45	--	48
Hackberry	15	28	43	--	45	--	30	--	--	--	149
Sycamore	7	--	--	--	--	--	65	28	--	--	--
Other hardwoods	57	42	145	--	214	--	8	26	455	--	432
All species	249	169	374	528	452	1,755	442	683	702	--	959
Number of plots	83	8	8	1	3	1	4	2	2	--	1
Standard error[3]	31	44	76	R	145	R	79	358	292	--	R
Average basal area	43	36	76	68	65	82	66	75	83	--	68

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

[3] R indicates that there was an insufficient number of plots to compute the standard error.

Table 13.--Board foot volume per acre in sawtimber and short-log trees by species group and stand-age class, Kansas, 1981[1]

Oak-hickory forest type - All site index classes

(In board feet per acre)[2]

Species group	Average[3]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	6	--	--	--	--	25	--	--	--	--	--
Select white oak	709	288	295	414	677	628	1,185	549	1,382	1,565	1,060
Other white oak	43	21	--	--	40	166	37	135	97	7	--
Select red oak	500	169	324	599	342	708	945	580	994	625	587
Other red oak	363	153	125	48	294	373	397	441	1,076	517	1,166
Select hickory	180	270	118	61	86	255	162	604	316	183	160
Other hickory	49	18	42	--	50	37	19	--	76	268	82
Hard maple	12	--	12	19	--	40	--	31	13	31	--
Soft maple	8	--	--	--	--	--	--	79	32	--	--
Ash	61	37	--	13	51	26	264	60	52	135	30
Cottonwood	21	16	--	53	13	--	53	--	--	46	--
Willow	3	--	--	--	14	--	--	--	--	--	24
Basswood	41	--	7	41	16	104	12	64	42	50	35
Black walnut	116	55	14	59	204	189	236	175	66	119	119
Elm	36	29	16	5	35	74	36	85	70	22	59
Hackberry	73	22	96	28	110	148	49	14	205	58	36
Sycamore	43	--	23	--	13	62	18	67	179	100	--
Other hardwoods	42	44	55	54	14	36	90	--	51	71	59
All species	2,306	1,122	1,127	1,394	1,959	2,871	3,503	2,884	4,651	3,797	3,417
Number of plots	252	14	20	22	27	24	25	17	18	20	11
Standard error	123	378	229	288	307	378	362	336	581	402	487
Average basal area	68	67	66	73	86	73	80	63	89	72	72

[1] Forest type definitions and species group list are in Appendix A.

[2] International 1/4-inch rule.

[3] Average column based on weighted average over all plots including those aged 1-20 years.

Table 14.--Board foot volume per acre in sawtimber and short-log trees by species group and stand-age class, Kansas, 1981[1]

Post-blackjack oak forest type - All site index classes

(In board feet per acre)[2]

Species group	Average[3]	Stand-age class (years)								
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	27	--	59	--	164	--	--	97	--	--	--
Other white oak	755	--	300	403	645	837	2,068	1,816	--	779	--
Select red oak	87	--	--	--	465	--	--	--	--	1,800	--
Other red oak	126	174	--	199	244	--	--	76	--	--	--
Select hickory	51	--	--	42	--	--	303	--	--	--	--
Other hickory	--	--	--	--	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	--	--	--	--	--	--	--	--	--	--	--
Ash	--	--	--	--	--	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--
Willow	--	--	--	--	--	--	--	--	--	--	--
Basswood	--	--	--	--	--	--	--	--	--	--	--
Black walnut	--	--	--	--	--	--	--	--	--	--	--
Elm	3	--	--	--	--	80	--	--	--	--	--
Hackberry	12	--	--	--	--	--	--	99	--	--	--
Sycamore	--	--	--	--	--	--	--	--	--	--	--
Other hardwoods	10	--	--	--	--	--	--	--	--	247	--
All species	1,071	174	359	644	1,518	917	2,371	2,088	--	2,826	--
Number of plots	26	1	4	10	1	1	3	3	--	1	--
Standard error[4]	195	R	211	226	R	R	282	564	--	R	--
Average basal area	80	82	102	89	71	56	60	74	--	71	--

[1] Forest type definitions and species group list are in Appendix A.

[2] International 1/4-inch rule.

[3] Average column based on weighted average over all plots including those aged 1-20 years.

[4] R indicates that there was an insufficient number of plots to compute the standard error.

Table 15.--Board foot volume per acre in sawtimber and short-log trees by species group and stand-age class, Kansas, 1981[1]

Upland plains hardwoods forest type - All site index classes

(In board feet per acre)[2]

Species group	Average[3]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	327	--	--	410	766	384	486	653	--	627	1,263
Other white oak	35	--	--	--	--	--	--	--	--	--	--
Select red oak	72	--	--	--	80	78	--	1,667	--	--	--
Other red oak	46	--	--	45	64	213	--	--	--	--	--
Select hickory	27	--	--	--	93	38	364	--	--	--	--
Other hickory	--	--	--	--	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	--	--	--	--	--	--	--	--	--	--	--
Ash	36	--	--	--	133	51	--	--	--	--	--
Cottonwood	70	--	--	--	--	139	--	--	--	--	945
Willow	--	--	--	--	--	--	--	--	--	--	--
Basswood	173	--	--	--	--	643	2,895	--	--	--	--
Black walnut	358	631	195	261	1,053	581	--	--	--	210	--
Elm	60	--	--	96	--	97	--	--	--	--	73
Hackberry	291	464	436	--	496	842	--	254	--	--	--
Sycamore	27	--	--	104	--	43	--	377	--	--	--
Other hardwoods	108	--	41	--	--	577	--	--	--	283	136
All species	1,630	1,095	672	916	2,685	3,686	3,745	2,951	--	1,120	2,417
Number of plots	39	3	5	4	5	6	1	1	--	1	2
Standard error[4]	268	704	324	482	521	942	R	R	--	R	734
Average basal area	66	69	79	72	64	73	64	82	--	49	67

[1] Forest type definitions and species group list are in Appendix A.

[2] International ¼-inch rule.

[3] Average column based on weighted average over all plots including those aged 1-20 years.

[4] R indicates that there was an insufficient number of plots to compute the standard error.

Table 16.--Board foot volume per acre in sawtimber and short-log trees by species group and stand-age class, Kansas, 1981[1]

Elm-ash-cottonwood forest type - All site index classes

(In board feet per acre)[2]

		Stand-age class (years)									
Species group	Average[3]	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	124	19	36	223	102	143	120	366	536	100	--
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	46	12	--	--	99	79	--	163	--	--	--
Other red oak	19	33	--	--	--	46	--	25	--	--	--
Select hickory	54	29	29	--	174	52	114	77	--	--	--
Other hickory	18	--	--	--	20	24	--	--	--	--	--
Hard maple	9	--	--	--	--	--	--	71	--	--	--
Soft maple	299	29	--	173	350	409	756	215	1,333	482	--
Ash	461	133	228	1,274	679	458	1,071	613	876	450	--
Cottonwood	596	99	180	28	413	1,734	512	805	1,098	4,371	--
Willow	149	--	88	207	463	379	145	57	--	--	--
Basswood	12	--	--	84	--	17	--	48	--	--	--
Black walnut	61	63	12	151	91	74	75	41	48	198	--
Elm	125	149	91	77	143	225	354	133	68	--	--
Hackberry	176	161	117	567	336	138	198	207	47	128	--
Sycamore	176	104	78	--	192	479	469	244	152	--	--
Other hardwoods	216	45	138	499	308	503	398	78	337	235	--
All species	2,541	876	997	3,283	3,370	4,760	4,212	3,143	4,495	5,964	--
Number of plots	189	12	12	10	26	21	20	18	7	4	--
Standard error	214	248	234	853	487	981	627	383	1,842	2,112	--
Average basal area	66	59	78	65	84	84	81	79	65	81	--

[1] Forest type definitions and species group list are in Appendix A.

[2] International 1/4-inch rule.

[3] Average column based on weighted average over all plots including those aged 1-20 years.

Table 17.--Board foot volume per acre in sawtimber and short-log trees by species group and stand-age class, Kansas, 1981[1]

Cottonwood forest type - All site index classes

(In board feet per acre)[2]

Species group	Average[3]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	--	--	--	--	--	--	--	--	--	--	--
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	--	--	--	--	--	--	--	--	--	--	--
Other red oak	--	--	--	--	--	--	--	--	--	--	--
Select hickory	--	--	--	--	--	--	--	--	--	--	--
Other hickory	--	--	--	--	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	9	--	--	152	--	--	--	--	--	--	--
Ash	41	--	--	--	--	58	--	--	102	152	--
Cottonwood	5,693	462	1,239	1,830	6,220	7,487	5,299	8,059	11,041	7,227	--
Willow	51	--	--	147	--	73	165	--	--	--	--
Basswood	--	--	--	--	--	--	--	--	--	--	--
Black walnut	13	--	--	--	--	49	--	--	--	--	--
Elm	22	--	--	--	--	86	--	--	--	--	--
Hackberry	23	--	--	--	--	89	--	--	--	--	--
Sycamore	22	--	--	--	--	--	--	--	253	--	--
Other hardwoods	20	--	--	--	--	45	--	--	--	77	--
All species	5,894	462	1,239	2,129	6,220	7,887	5,464	8,059	11,396	7,456	--
Number of plots	35	2	3	2	3	9	5	2	3	4	--
Standard error	833	186	782	1,024	2,823	1,678	2,233	2,067	2,556	2,145	--
Average basal area	90	73	65	68	86	100	76	154	105	114	--

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[1] Forest type definitions and species group list are in Appendix A.

[2] International 1/4-inch rule.

[3] Average column based on weighted average over all plots including those aged 1-20 years.

Table 18.--Board foot volume per acre in sawtimber and short-log trees by species group and stand-age class, Kansas, 1981[1]

Lowland plains hardwoods forest type - All site index classes

(In board feet per acre)[2]

Species group	Average[3]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	464	84	234	316	228	452	676	1,404	578	1,345	2,110
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	52	--	17	--	101	51	59	72	78	164	--
Other red oak	21	--	--	--	23	24	--	32	--	96	--
Select hickory	15	--	19	--	12	51	--	25	24	--	--
Other hickory	38	--	83	49	52	23	32	68	86	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	90	--	--	--	168	238	59	32	71	--	--
Ash	151	--	32	34	248	204	186	360	113	244	--
Cottonwood	86	71	56	--	113	62	43	--	265	624	--
Willow	7	--	5	--	15	--	22	--	--	--	--
Basswood	7	--	--	--	--	--	13	--	--	59	--
Black walnut	437	254	303	457	614	661	521	187	330	291	449
Elm	97	28	42	60	82	140	120	101	179	237	110
Hackberry	937	188	509	756	873	1,010	1,366	1,876	1,168	1,536	1,533
Sycamore	206	108	82	--	221	186	456	43	332	--	1,099
Other hardwoods	175	--	222	351	249	209	227	226	130	9	--
All species	2,783	733	1,604	2,023	2,999	3,311	3,780	4,426	3,354	4,605	5,301
Number of plots	205	10	17	9	29	35	37	11	17	6	2
Standard error	140	173	213	435	338	309	317	739	389	783	2,555
Average basal area	72	51	82	67	77	75	81	86	69	95	88

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[1] Forest type definitions and species group list are in Appendix A.

[2] International 1/4-inch rule.

[3] Average column based on weighted average over all plots including those aged 1-20 years.

Table 19.--Board foot volume per acre in sawtimber and short-log trees by species group and stand-age class, Kansas, 1981[1]

Upland elm-ash-locust forest type - All site index classes

(In board feet per acre)[2]

Species group	Average[3]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	9	94	--	--	--	--	--	--	--	--	--
Select white oak	70	--	370	107	--	439	--	397	--	--	--
Other white oak	4	--	--	--	--	--	76	--	--	--	--
Select red oak	48	36	--	--	--	874	86	833	--	--	--
Other red oak	15	--	43	--	--	393	--	--	148	--	--
Select hickory	24	--	--	323	--	449	--	--	296	--	--
Other hickory	3	--	--	--	--	--	67	--	--	--	--
Hard maple	12	--	--	--	--	1,022	--	--	--	--	--
Soft maple	5	--	--	--	--	--	--	--	--	--	--
Ash	24	--	--	--	--	--	41	195	--	--	--
Cottonwood	40	85	67	--	--	--	252	--	--	--	714
Willow	7	--	--	--	--	--	115	--	--	--	--
Basswood	38	--	--	--	--	2,733	--	191	--	--	--
Black walnut	72	--	186	265	--	425	39	110	288	--	--
Elm	50	--	34	539	407	--	196	--	--	--	--
Hackberry	29	27	103	--	116	--	--	--	--	--	261
Sycamore	27	--	--	--	--	--	244	133	--	--	--
Other hardwoods	142	59	333	--	868	--	--	--	1,215	--	1,251
All species	619	301	1,136	1,234	1,391	6,335	1,116	1,859	1,947	--	2,226
Number of plots	83	8	8	1	3	1	4	2	2	--	1
Standard error[4]	107	109	437	R	510	R	419	845	472	--	R
Average basal area	43	36	76	68	65	82	66	75	83	--	68

[1] Forest type definitions and species group list are in Appendix A.

[2] International 1/4-inch rule.

[3] Average column based on weighted average over all plots including those aged 1-20 years.

[4] R indicates that there was an insufficient number of plots to compute the standard error.

Table 20.--Biomass yields per acre in all live trees by species group and stand-age class, Kansas, 1981[1]

Oak-hickory forest type - All site index classes

(In pounds per acre green weight)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	281	--	254	198	692	346	99	--	--	--	--
Select white oak	29,758	31,057	26,048	28,469	36,766	25,400	40,142	17,431	40,920	41,086	36,682
Other white oak	3,061	854	4,927	3,491	4,444	5,197	3,586	5,388	3,167	558	--
Select red oak	15,493	6,041	13,434	22,446	15,596	23,389	24,093	15,805	21,616	17,111	17,636
Other red oak	10,321	9,260	7,816	4,345	7,689	12,419	9,375	10,351	23,226	15,617	21,445
Select hickory	9,678	20,716	9,719	4,683	15,209	8,013	7,209	16,344	12,316	8,001	9,771
Other hickory	3,358	2,276	4,183	5,186	5,800	4,196	2,827	713	3,404	2,688	3,009
Hard maple	1,000	--	861	1,355	--	2,590	588	2,445	1,230	1,868	2,453
Soft maple	148	--	--	--	--	--	146	1,352	441	--	--
Ash	3,168	1,409	4,364	5,576	3,257	2,961	6,176	2,455	2,674	5,452	1,184
Cottonwood	469	286	--	1,144	254	--	953	--	--	1,231	--
Willow	122	--	--	--	257	--	676	--	--	99	453
Basswood	1,098	--	123	2,383	609	3,016	341	1,045	889	1,082	1,696
Black walnut	5,180	7,177	3,142	4,610	8,101	7,209	6,137	6,395	4,960	4,577	3,665
Elm	4,676	2,667	2,496	4,306	4,205	7,279	3,761	6,168	6,794	6,987	5,171
Hackberry	2,612	1,677	1,453	2,194	3,054	3,611	3,267	269	7,996	2,190	2,829
Sycamore	979	747	380	--	380	1,322	214	1,262	2,724	2,299	242
Other hardwoods	2,854	4,289	5,202	2,450	2,610	2,002	4,006	2,106	3,281	3,512	1,360
Noncommercial species	3,633	3,817	9,325	1,036	5,040	5,497	2,096	5,061	5,304	2,054	2,775
All species	97,889	92,273	93,727	93,872	113,963	114,447	115,692	94,590	140,942	116,412	110,371
Number of plots	252	14	20	22	27	24	25	17	18	20	11
Standard error	3,099	17,542	14,284	7,333	7,902	10,534	8,092	6,840	9,339	11,167	7,745
Average basal area	68	67	66	73	86	73	80	63	89	72	72

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 21.--Biomass yields per acre in all live trees by species group and stand-age class, Kansas, 1981[1]

Post-blackjack oak forest type - All site index classes

(In pounds per acre green weight)

Species group	Average[2]	Stand-age class (years) 21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	2,117	--	9,985	--	8,860	--	--	2,080	--	--	--
Other white oak	69,908	75,000	72,955	90,302	41,660	45,060	54,647	69,440	--	41,560	--
Select red oak	4,361	--	6,610	1,094	25,020	--	--	--	--	50,980	--
Other red oak	10,912	23,780	11,645	11,776	12,400	--	6,273	3,780	--	4,760	--
Select hickory	1,448	--	--	2,050	--	--	4,567	1,147	--	--	--
Other hickory	1,320	--	1,040	--	--	--	8,080	1,973	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	--	--	--	--	--	--	--	--	--	--	--
Ash	--	--	--	--	--	--	--	--	--	--	--
Cottonwood	--	--	--	--	--	--	--	--	--	--	--
Willow	--	--	--	--	--	--	--	--	--	--	--
Basswood	--	--	--	--	--	--	--	--	--	--	--
Black walnut	1,123	--	2,690	312	--	--	4,133	973	--	--	--
Elm	897	--	--	494	--	3,140	1,593	3,487	--	--	--
Hackberry	281	--	--	--	--	--	--	2,433	--	--	--
Sycamore	--	--	--	--	--	--	--	--	--	--	--
Other hardwoods	495	--	--	--	--	--	--	2,440	--	5,540	--
Noncommercial species	424	--	--	580	--	--	1,267	473	--	--	--
All species	93,286	98,780	104,925	106,608	87,940	48,200	80,560	88,226	--	102,840	--
Number of plots	26	1	4	10	1	1	3	3	--	1	--
Standard error[3]	6,241	R	13,826	10,398	R	R	20,443	9,062	--	R	--
Average basal area	80	82	102	89	71	56	60	74	--	71	--

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[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

[3] R indicates that there was an insufficient number of plots to compute the standard error.

Table 22.--Biomass yields per acre in all live trees by species group and stand-age class, Kansas, 1981[1]

Upland plains hardwoods forest type - All site index classes

(In pounds per acre green weight)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	1,193	--	1,336	465	--	--	--	--	--	--	--
Select white oak	13,789	6,967	380	12,190	18,764	17,947	11,400	12,100	--	23,460	33,710
Other white oak	864	--	--	1,900	--	--	--	--	--	--	--
Select red oak	1,966	--	--	1,090	4,480	1,407	--	25,800	--	--	--
Other red oak	1,166	--	--	1,035	2,704	4,637	--	--	--	--	--
Select hickory	1,112	--	--	2,030	1,684	807	6,700	--	--	--	--
Other hickory	1,649	--	4,204	4,690	148	63	4,820	9,180	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	--	--	--	--	--	--	--	--	--	--	--
Ash	2,534	8,587	--	1,625	4,788	1,763	--	--	--	--	7,020
Cottonwood	1,343	--	--	--	--	3,327	--	--	--	--	16,200
Willow	116	--	--	1,130	--	--	--	--	--	--	--
Basswood	3,790	--	--	--	--	12,653	54,040	--	--	--	--
Black walnut	16,783	22,560	10,720	22,085	25,660	9,387	3,940	13,340	--	15,380	8,010
Elm	7,609	12,113	17,464	12,385	2,120	5,867	2,320	16,640	--	--	4,720
Hackberry	14,429	42,753	11,336	6,010	18,624	30,273	5,540	11,400	--	2,880	4,960
Sycamore	624	--	--	2,650	--	1,333	--	5,720	--	--	--
Other hardwoods	7,764	2,847	17,856	2,470	5,064	21,400	--	3,980	--	5,080	3,640
Noncommercial species	10,530	21,420	19,032	1,955	16,004	--	--	--	--	7,320	7,510
All species	87,261	117,247	82,328	73,710	100,040	110,864	88,760	98,160	--	54,120	85,770
Number of plots	39	3	5	4	5	6	1	1	--	1	2
Standard error[3]	6,914	29,862	13,517	9,266	19,931	32,391	R	R	--	R	32,770
Average basal area	66	69	79	72	64	73	64	82	--	49	67

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

[3] R indicates that there was an insufficient number of plots to compute the standard error.

Table 23.--Biomass yields per acre in all live trees by species group and stand-age class, Kansas, 1981[1]

Elm-ash-cottonwood forest type - All site index classes

(In pounds per acre green weight)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	37	--	358	--	--	--	--	--	--	--	--
Select white oak	3,393	1,077	2,112	3,300	3,150	3,299	2,413	11,129	9,969	3,845	--
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	1,077	967	760	--	2,018	1,286	470	3,469	--	--	--
Other red oak	649	800	--	--	--	1,880	278	536	--	--	--
Select hickory	1,813	692	4,673	--	4,496	1,155	2,848	1,854	--	--	--
Other hickory	842	--	1,973	502	712	706	--	--	--	--	--
Hard maple	530	--	--	--	--	770	--	4,047	--	--	--
Soft maple	6,987	793	--	4,190	8,675	9,065	20,225	4,777	23,197	12,765	--
Ash	16,657	12,647	26,883	32,886	23,790	16,085	30,527	18,093	19,037	23,065	--
Cottonwood	12,335	1,933	3,068	1,180	9,585	32,446	9,547	20,062	18,103	72,495	--
Willow	4,408	712	3,672	5,358	11,828	9,389	3,787	1,678	1,557	--	--
Basswood	257	--	--	1374	--	549	--	1044	--	--	--
Black walnut	2,946	3,045	2,812	5,640	2,570	4,059	1,871	2,462	874	9,830	--
Elm	11,743	14,530	8,957	6,960	9,891	16,564	13,374	14,294	3,766	7,250	--
Hackberry	7,987	6,808	6,697	16,424	15,141	7,661	8,438	8,116	2,806	5,940	--
Sycamore	3,051	2,210	1,508	--	4,020	8,087	7,056	3,311	2,280	--	--
Other hardwoods	15,786	17,522	21,268	27,660	18,585	26,606	22,272	9,606	11,683	11,520	--
Noncommercial species	5,419	7,778	14,192	2,054	1,147	3,609	2,819	2,948	--	4,050	--
All species	95,917	71,514	98,933	107,528	115,608	143,216	125,925	107,426	93,272	150,760	--
Number of plots	189	12	12	10	26	21	20	18	7	4	--
Standard error	4,749	9,267	15,712	19,632	13,783	16,790	13,760	14,521	29,513	27,426	--
Average basal area	66	59	78	65	84	84	81	79	65	81	--

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 24.--Biomass yields per acre in all live trees by species group and stand-age class, Kansas, 1981[1]

Cottonwood forest type - All site index classes

(In pounds per acre green weight)

Species group	Average[2]	Stand-age class (years) 21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	--
Select white oak	--	--	--	--	--	--	--	--	--	--	--
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	--	--	--	--	--	--	--	--	--	--	--
Other red oak	80	1,400	--	--	--	--	--	--	--	--	--
Select hickory	--	--	--	--	--	--	--	--	--	--	--
Other hickory	--	--	--	--	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--
Soft maple	687	--	5,613	3,610	--	--	--	--	--	--	--
Ash	2,630	--	--	2,490	--	2,078	3,352	5,880	2,007	8,460	--
Cottonwood	125,982	75,030	78,213	67,540	141,447	152,669	102,844	194,950	190,953	137,870	--
Willow	2,232	2,250	513	2,850	--	4,269	3,892	--	1,627	--	--
Basswood	2,241	--	--	--	--	--	--	39,220	--	--	--
Black walnut	1,375	--	--	--	--	5,347	--	--	--	--	--
Elm	2,829	--	--	--	8,427	4,153	--	13,280	2,560	525	--
Hackberry	2,216	--	--	--	3,607	7,024	--	--	--	880	--
Sycamore	792	5,020	--	--	--	533	--	--	4,293	--	--
Other hardwoods	9,624	2,060	4,260	9,610	10,153	6,787	5,648	34,770	6,233	20,260	--
Noncommercial species	71	--	--	--	--	--	--	--	--	625	--
All species	150,759	85,760	88,599	86,100	163,634	182,860	115,736	288,100	207,673	168,620	--
Number of plots	35	2	3	2	3	9	5	2	3	4	--
Standard error	16,661	25,900	31,490	37,040	47,376	37,776	43,030	83,480	45,846	43,237	--
Average basal area	90	73	65	68	86	100	76	154	105	114	--

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 25.--Biomass yields per acre in all live trees by species group and stand-age class, Kansas, 1981[1]

Lowland plains hardwoods forest type - All site index classes

(In pounds per acre green weight)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	218	--	548	853	--	--	44	--	--	--	--
Select white oak	11,451	1,756	5,752	11,564	7,690	10,231	15,528	31,715	14,547	36,033	46,810
Other white oak	--	--	--	--	--	--	--	--	--	--	--
Select red oak	1,639	--	833	--	3,279	1,870	1,373	1,513	2,765	2,970	--
Other red oak	800	--	--	547	907	1,527	208	700	281	2,180	--
Select hickory	796	--	1,441	--	1,340	1,694	--	649	448	--	--
Other hickory	2,001	--	6,999	1,600	3,252	943	1,357	2,184	2,440	--	--
Hard maple	71	--	--	--	392	--	--	--	--	--	--
Soft maple	2,166	--	--	--	4,423	4,966	1,308	2,427	2,593	--	--
Ash	4,930	--	3,018	3,724	7,697	5,513	5,204	9,725	5,306	6,980	--
Cottonwood	1,735	2,512	1,106	--	1,914	1,550	1,206	--	5,026	10,620	--
Willow	408	1,774	1,574	473	524	--	535	--	--	--	--
Basswood	379	--	245	524	--	316	619	1,436	--	1,313	--
Black walnut	15,299	16,846	25,274	18,718	21,302	17,023	12,722	3,395	9,711	8,320	8,180
Elm	7,637	8,582	5,256	5,038	7,466	8,117	9,748	8,062	10,494	13,880	5,960
Hackberry	30,468	19,048	24,058	23,407	30,029	29,902	39,329	61,925	31,342	52,057	41,860
Sycamore	4,038	2,260	1,728	--	3,921	4,495	7,791	1,625	6,507	--	29,350
Other hardwoods	11,086	6,368	12,911	13,976	12,914	12,521	12,919	9,051	6,221	5,237	2,150
Noncommercial species	4,034	2,534	8,806	4,682	4,529	3,598	2,853	--	389	5,257	--
All species	99,156	61,680	99,549	85,106	111,579	104,266	112,744	134,407	98,070	144,847	134,310
Number of plots	205	10	17	9	29	35	37	11	17	6	2
Standard error	3,238	8,259	5,106	13,532	8,149	8,198	7,754	15,245	7,664	23,891	49,670
Average basal area	72	51	82	67	77	75	81	86	69	95	88

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

Table 26.--Biomass yields per acre in all live trees by species group and stand-age class, Kansas, 1981[1]

Upland elm-ash-locust forest type - All site index classes

(In pounds per acre green weight)

Species group	Average[2]	Stand-age class (years)									
		21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121+
Eastern redcedar	531	1,557	1,010	7,120	--	--	--	--	--	--	--
Select white oak	1,999	--	5,475	25,560	--	8,960	1,160	10,790	--	--	--
Other white oak	67	--	--	--	--	--	1,395	--	--	--	--
Select red oak	2,101	913	--	--	--	47,200	1,845	23,420	--	--	--
Other red oak	515	--	988	--	--	9,780	--	--	2,950	--	--
Select hickory	1,037	--	--	7,240	--	16,140	--	4,240	9,530	--	--
Other hickory	177	--	--	--	--	8,340	1,240	710	--	--	--
Hard maple	500	--	--	--	--	41,520	--	--	--	--	--
Soft maple	215	--	--	--	--	--	--	--	--	--	--
Ash	4,005	--	1,035	740	--	--	9,660	24,480	--	--	--
Cottonwood	1,545	2,850	4,345	--	--	--	4,635	--	--	--	31,940
Willow	525	--	--	--	--	--	1,925	--	--	--	7,120
Basswood	593	--	--	--	--	43,260	--	2,960	--	--	--
Black walnut	3,419	955	6,897	17,700	4,153	7,600	2,175	3,290	10,280	--	--
Elm	10,900	14,660	7,945	19,140	14,893	--	26,665	20,950	13,060	--	4,300
Hackberry	3,494	3,008	5,793	5,660	4,213	--	10,850	--	--	--	14,080
Sycamore	552	--	--	--	--	--	5,350	2,600	--	--	--
Other hardwoods	10,298	5,037	28,685	--	35,880	--	2,630	4,230	49,830	--	47,620
Noncommercial species	5,513	10,978	16,400	--	22,007	9,320	7,515	--	5,690	--	--
All species	47,986	39,958	78,573	83,160	81,146	192,120	77,045	97,670	91,340	--	105,060
Number of plots	83	8	8	1	3	1	4	2	2	--	1
Standard error[3]	4,181	7,733	10,815	R	27,265	R	9,548	23,490	34,340	--	R
Average basal area	43	36	76	68	65	82	66	75	83	--	68

[1] Forest type definitions and species group list are in Appendix A.

[2] Average column based on weighted average over all plots including those aged 1-20 years.

[3] R indicates that there was an insufficient number of plots to compute the standard error.

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Smith, W. Brad; Hackett, Ronald L.
Forest biomass and empirical yield for Kansas. Resour. Bull. NC-81. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1984. 32 p.

Methods for computing tree and shrub biomass. Presents empirical yield tables for cubic foot and board foot volume.

KEY WORDS: Tree weights, tops and limbs, tall shrubs, low shrubs, green tons, green pounds, cubic foot, board foot.

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